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Regional frequency analysis of extreme precipitation in north-eastern Italy and the September 26, 2007 flash flood

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The 26 September 2007 storm on the metropolitan area of Venice in North-eastern Italy is examined as a prototype for organized convective systems that dominate the upper tail of the precipitation frequency distribution in the coastal area of this region. This storm, with a duration of 6 hours, was characterized by extraordinary rainfall amounts and large spatial variability. The study addresses questions concerning the frequency distribution of the extreme storm events in this area. More specifically, we want to assess the severity of the flash flood generating storm by using annual maximum data from the regional network, a dense raingauge network and two C-band Doppler radar which surveyed the storm.

Regional frequency analysis based on the index variable method and L-moments is utilized to analyse short duration annual maximum precipitation for the whole north-eastern Italy, and the Veneto Region in particular, which includes the storm location. It is shown that the regional growth curves based on the GEV and the Kappa distribution may be useful for the subregions specified. This analysis provides a framework to investigate the frequency characteristics of the September 26, 2007 flash flood generating storm for various rainfall durations. Radar rainfall estimates, adjusted by using a physically-based methodology and data from a raingauge network, are used to characterize the return period of the storm rainfall amounts, highlighting the importance of considering its spatial dimension.

It is shown that adjusted radar rainfall estimates may suffer for considerable uncertainty and that the uncertainty magnifies in the evaluation of the relevant return periods. The analysis shows also that (i) attributing a single return period to a storm event is not realistic, and (ii) the severity of flash flood generating storms is poorly captured even by using a dense conventional raingauge networks.